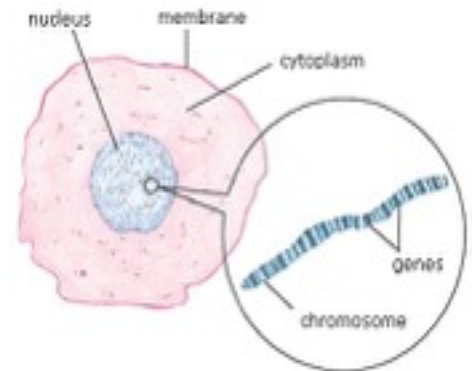


# Lab method for extracting DNA from human CHEEK CELLS

## See Your DNA = Crack the Code of Life

### Materials

- Salt Solution = 10 ml
- Liquid detergent = 1 ml
- Ethyl Alcohol (COLD) = 5 ml (Put on ICE)
- 1 plastic cup
- 1 - 50 ml beakers or cups
- 1 - Graduated cylinder - small
- Glass stirring rod or wooden stick for stirring mixture
- Eye dropper or paper towel – may be needed to remove foam
- Paper clip hook for collecting DNA



1. Pour 10 milliliters of salt solution into a plastic cup. Take the 10 ml salt solution and **vigorously** swish it in your mouth, making sure to rub your tongue along your cheeks and chew on your cheek (use your teeth, but NO BLOOD) for 30 seconds. This amount of swishing will actually become quite laborious—hang in there! Just remember: “spit happens”.
2. **CAREFULLY** spit salt solution back into cup; then pour 10 ml of spit into *clean* 50 ml beaker.
3. Add 1 milliliter (15 – 18 drops) of liquid detergent to the beaker.
4. Using stirring rod **gently** mix the contents for 5 minutes. DO NOT MAKE FOAM. Use paper towel to remove foam that might be made. *(The detergent will break open the cell membrane to release the DNA into the soap solution. Do not be too vigorous while mixing! DNA is a very long molecule. Physical abuse can break it into smaller fragments, a process known as shearing.)*
5. Slightly tilt beaker and pour 5 ml fluid ounces of the chilled ethyl alcohol SLOWLY down the side of the beaker so that it forms a layer on the top of your soapy solution. DO NOT TIP, SHAKE, OR MIX THE BEAKER or you may not see the DNA. *Put beaker down on table and then “get down” and look.*
6. Wait for about 5 minutes and watch as the DNA floats to the surface. If you look to the line of separation between the two layers, or the interface, you will start to see bubbles attached with tiny hair like white strings. These strings are your DNA
7. Use the glass rod or wooden stick to remove DNA from beaker by twirling the rod or stick in a circular motion. Be careful to minimize mixing of alcohol and soapy layers. If too much shearing has occurred, the DNA fragments may be too short to wind up, and they may form clumps instead. Place on paper towel and dry DNA **OR**
8. If time permits, place small sample of DNA on slide; look at it with microscope.



**Be sure to share results with all lab partners!!!**

## DNA EXTRACTION

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Section: \_\_\_\_\_

**Be sure to read lab notes before you begin!**

1. List three things available to you that you might use for a DNA source besides wheat germ, onion, cheek cells or split peas.
  
2. List three things that would **not** be a DNA source.
  
3. What is the role/purpose of DNA in a cell?
  
4. Explain how DNA is contained in a cell.
  
5. a. Describe what you saw happening in the beaker.  
  
b. Describe the product that was obtained.
  
6. What is an Enzyme?
  
7. Why did you use detergent in the procedure, and how does it work? (*see notes on back*)
  
8. What possible benefits might be obtained by the ability to isolate the DNA of any organism?

## HOW DOES IT WORK?

DNA is present in all living things from bacteria to plants to animals. In animals, it is found in almost all cell types: cheek, muscles, reproductive cells, hair roots, -- anything with a nucleus.

*DNA is NOT found in Red blood cells because they lack nuclei.* White blood cells do have a nucleus.

DNA in a cell is about 100,000 times as long as the cell itself. However, DNA only takes up about 10% of the cell's volume. How can this be? This is because the DNA molecules fold themselves many times to pack themselves in the cell's nucleus.

Each chromosome contains a single immense molecule of DNA that, in humans, has a length of up to 12 centimeters when stretched out! (*look at 12 cm on ruler*) As a matter of fact, all the DNA in one human cell (on all 46 chromosomes) is about two meters long, yet fits into a cell nucleus which is 2-3 micrometers (that's .000002 meters wide!). Yet, the DNA must still be in such a state as to allow for enzymes to replicate the molecule or initiate the production of a protein. The 23 pairs of human chromosomes are estimated to include about 100,000 genes.

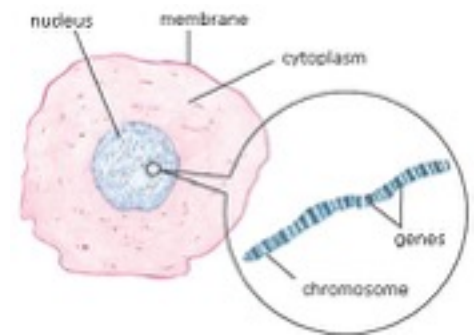
## CHEEK CELLS

Cheek cells come from the inner lining of mouth or the cheek.

These cells are routinely shed and replaced by new cells.

As the old cells die, they accumulate in the saliva in the mouth and can easily be collected by using mouthwash.

One might say “Spit Happens”.



## Water temperature

The heat softens the phospholipids (fats) in the membranes that surround the cell and the nucleus.

It also inactivates (**denatures**) the *deoxyribonuclease enzymes* (Dnase) which, if present, would cut the DNA into such small fragments that it would not be visible. Denatured enzymes and DNA unravel, lose their shape, and thus become inactive. Enzymes denature at 60°C and DNA denatures at 80°C.

## Detergent

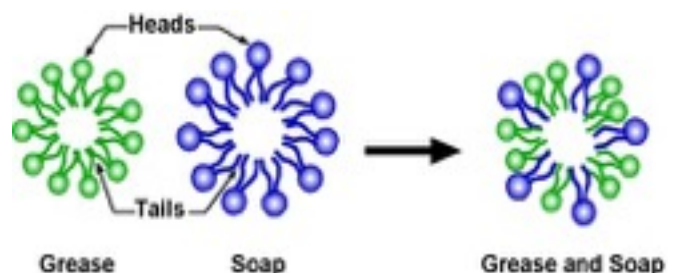
Detergent contains *sodium laurel sulfate*, which cleans dishes by removing fats and proteins. It acts the same way in the DNA extraction, pulling apart the fats (*lipids*) and proteins that make up the membranes surrounding the cell and the nucleus. Once these membranes are broken apart, the DNA is released from the cell.

Soap molecules and grease molecules are made of two parts:

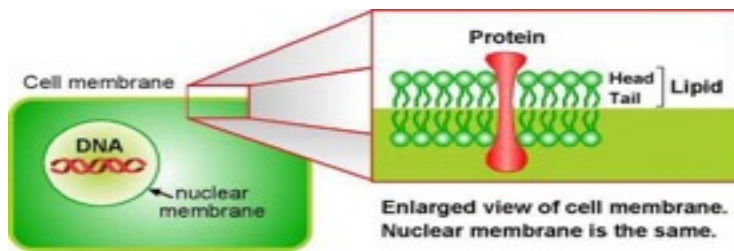
Hydrophilic **heads**: which LIKE water and Hydrophobic **tails** which HATE water

Both soap and grease molecules organize themselves in bubbles (spheres) with heads outside to face the water and tails inside to hide from the water.

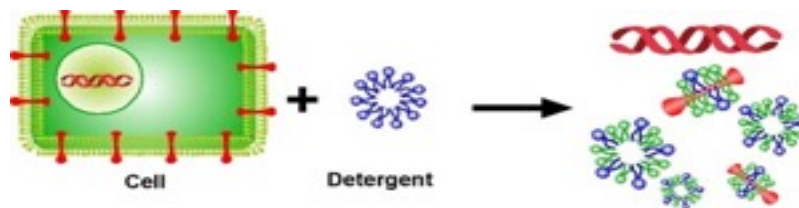
When soap comes close to grease, it captures it, forming a greasy soapy ball:



A cell's membrane has two layers of lipid (fat) molecules with proteins between them:



When detergent comes close to cell, it captures the lipids & proteins & releases DNA:



### Alcohol

The DNA released from the cell nucleus is dissolved in the *water/detergent/wheat germ solution* and cannot be seen. DNA precipitates out of solution in alcohol, where it can be seen. Besides allowing us to see the DNA, the alcohol *separates* the DNA from the other cell components, which are left behind in the water solution. The alcohol also causes gases dissolved in the water to be released, which may be observed as small bubbles.